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Forest Insect and Disease Conditions 1979 in the Northern Region

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ROCKY MOUNTAIN STATION

compiled by
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Cover Photos

(front)
Figure 1. Douglas-fir with severe dwarf mistletoe infection. The large witches-brooms indicate the infection has been present for many years. The dead tree on the left was probably killed by dwarf mistletoe.

(back)
Figure 14. A portion of the extensive mountain pine beetle infestation in the North Fork Flathead River drainage (Glacier National Park and Flathead National Forest).

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Forest Service
Forest Insect and
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Introduction

This report documents the status of important forest insects and diseases in the Northern Region in 1979. This report, and similar reports prepared annually, provides an important historical record of forest pest conditions in the Region. In addition, this report provides forest land managers, the forest industry, and interested citizens with knowledge of the current extent and severity of forest pest infestations, and estimates of resource losses caused by some major pests.

Information reported here was gathered by personnel in the USDA-Forest Service, Division of State and Private Forestry; Idaho Department of Lands; and Montana Division of Forestry.

Conditions in Brief

Mountain pine beetle* continues to be the most damaging forest insect in the Northern Region. In 1979 populations were epidemic on more than 1.4 million acres of lodgepole, ponderosa, whitebark, and western white pine in Montana. Another 2,700 acres in northern Idaho were severely infested. Tree mortality caused by other bark beetle species was relatively light. Western spruce budworm continues to cause visible defoliation to vast areas of Douglas-fir/true fir forests. In 1979 2,271,422 acres of defoliation was observed by aerial surveyors; a reduction of 248,824 acres since 1978. Cone and seed destroying insects were particularly damaging in 1979, as is often the case in years of light cone crops. Forest tent caterpillar populations in North Dakota declined markedly, and only widely scattered defoliation was evident. Sawflies defoliated western larch in several areas in northern Idaho. Douglas-fir tussock moth trapping captured only a few male moths indicating that populations will remain endemic for at least another year. Populations of pine butterfly, gouty pitch midge, and a ponderosa pine needle miner have essentially collapsed.

Winter damage was widespread in northern Idaho and western Montana. Snow mold on Douglas-fir was locally prevalent throughout the Region for the first time. A Douglas-fir needle blight occurred in northwestern Montana. Lodgepole pine needle cast, although widespread, was locally severe only in northern Idaho. A closely related needle cast caused severe defoliation of whitebark pine in central Montana. Discoloration caused by Meria needle cast and Dothistroma needle blight declined notably. Gray mold caused damage to western larch in both nursery beds and greenhouses. Rodents girdled about 25 percent of western larch saplings left after thinning in areas of northwestern Montana. Activity of dwarf mistletoes, stem and root decays, stem rusts, and cankers did not fluctuate significantly.

**A listing of insect and disease common and scientific names is in appendix.*

Entomology

Bark Beetles

Mountain Pine Beetle

Mortality of lodgepole, whitebark, ponderosa and western white pine was extensive on more than 1.4 million acres in Montana and 2,700 acres in northern Idaho due to 1978 mountain pine beetle attacks (table 1 and figure 6). The epidemic area increased on the Beaverhead, Gallatin, Flathead, and Kootenai National Forests (NF); remained static on the Lolo NF; and declined in second-growth ponderosa pine stands on the Lewis & Clark NF. The expansion and intensification of the epidemic was particularly noticeable in Glacier and Yellowstone National Parks (NP). Extremely cold winter temperatures resulted in a brood reduction in some locations, however, beetle populations increased in most outbreak areas (figure 2).

Acreage figures are based on newly faded trees (those killed in 1978) and don't reflect killed trees that are still green (those killed in 1979).

Beaverhead National Forest. About 94,000 acres of lodgepole and whitebark pine are infested on the Madison Ranger District (RD). This is an increase of approximately 33,000 acres from 1978. Areas surveyed contain about 13 infested trees per acre. Infestations increased in the Centennial Valley, and in tributaries of the Tobacco Root Mountains. Mortality increased slightly in higher elevation lodgepole and whitebark pine stands on the west side of the Madison Range. New infestation was detected in Bear, Cameron, Tolman, Fall, and Spring Creek drainages. A few "hot spots" still persist in the Jack Creek drainage but decline in tree killing is expected in this area.

Gallatin National Forest. Despite temperature as cold as -62° F, millions of logepole pine were killed on about 441,000 acres on the Hebgen Lake, Bozeman-Gallatin, Livingston, and Gardiner RD's (figure 3). Newly attacked trees average 18 per acre in areas surveyed.

Figure 2. Mountain pine beetle killed lodgepole pine in Glacier National Park.

On the Hebgen Lake RD, area of visible faders increased from 79,000 acres in 1978 to 103,700 acres in 1979. General areas of infestation include the south end of the District, the south side of Quake Lake, drainages in the Madison Canyon, and the area around Reas Pass. About 13,000 trees were sprayed with Sevimol-4® to protect them from beetle attack in campgrounds and administrative sites.

On all ownerships in the Bozeman-Gallatin Ranger District's reporting area, acres of faders increased from 165,600 in 1978 to 333,800 in 1979. Increased numbers of trees killed by beetle attack in 1978 were evident in the following areas: the Gallatin Face, the south fork of Spanish Creek, the Gallatin Range, the Spanish Peaks Primitive Area, and the tributaries of the West Fork Gallatin River. Localized infestations were recorded throughout most drainages of the Bridger Mountains. The epidemic continued to decline due to host depletion in the north end of the Gallatin Canyon, where it began in 1969.

On the Livingston RD infestations developed in lodgepole pine stands on about 3,300 acres west of the Yellowstone River. New outbreaks are developing in several drainages including the Boulder River east of the Yellowstone River.

Infested groups of 5 to 100 trees per group were observed for the first time on 381 acres in the Tom Miner,

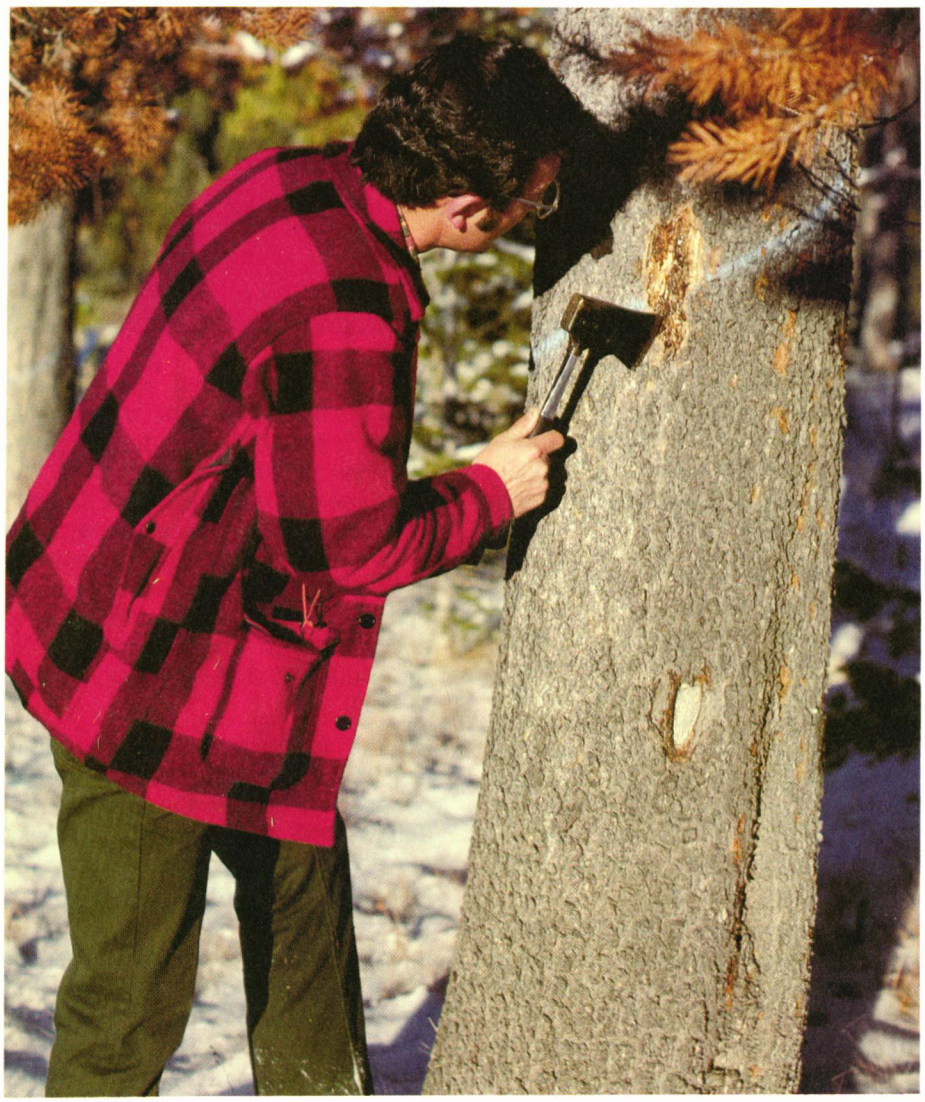
Mill, and Mal Heron drainages on the Gardiner RD.

Yellowstone National Park. The Yellowstone Park infestations increased in lodgepole and whitebark pine stands from 171,200 acres in 1978 to 431,000 acres in 1979, a factor of 2.5. Increased numbers of trees killed by beetle attack in 1978 were evident from Divide Lake and Crowfoot Pass south to the Bechler River and east to the Snake River.

Glacier National Park. Infestation in lodgepole and whitebark pine stands increased from about 164,000 acres in 1978 to more than 215,000 acres in 1979 in Glacier NP. Newly attacked trees where surveyed averaged about 52 per acre. Mountain pine beetle pressure is so intense that even Engelmann spruce is sometimes being attacked and killed. Millions of lodgepole pine have been killed from the Canadian border south to Park Headquarters.

In 1979 infestation was mapped for the first time on the east side of the Park, with extensive tree kill at Waterton Lake. Thousands of trees were infested in the Mokowanis and Belly River drainages north to the Canadian border. New infestation developed around Saint Mary, Sherburne, and Swift Current Lakes. Tree mortality intensified along the Middle Fork Flathead River drainage between West Glacier and Walton Ranger Station.

Figure 3. Assessing winter mortality of mountain pine beetle brood.



Flathead National Forest. The massive infestation on the Flathead NF expanded to about 121,000 acres in 1979. Newly attacked trees averaged 13 per acre in stands surveyed. On the Glacier View RD infestation occurs in all major drainages from Big Creek north to the Canadian border. Beetles emerging from infested log decks have infested several hundred acres of lodgepole pine around mills at Columbia Falls. Thousand of whitebark pine were killed on about 24,000 acres of high elevation stands. Several groups of 2 to 70 western white pines were beetle killed.

Numbers of lodgepole pine killed increased on all ownerships within the Swan Lake and Tally Lake RD's. Concentrations of up to 600 trees per group were killed near Olney and new infestations appeared along the Stillwater River between upper Stillwater and Bull Lakes. These new localized infestations create the potential for serious outbreaks which can spread to adjacent susceptible stands. Several hundred thousand lodgepole were attacked around McGregor Lake and hundreds more near Hubbart Lake. About 600 trees were sprayed with Sevimol-4® to protect them from beetle attack in two campgrounds on the Tally Lake RD.

About 800 western white pine on 1,200 acres were killed near Hungry Horse Reservoir, Hungry Horse RD. Mortality of lodgepole pine remained static with about 150 trees being killed in the South Fork drainage near Spotted Bear. The potential for a serious epidemic exists on the Hun-

gry Horse, Swan Lake, Spotted Bear, and Tally Lake RD's. Outbreaks that develop from small localized "hot spots" will intensify and encompass entire stands within the next few years. This pattern has occurred in the North Fork Flathead River drainage and on the south side of McGregor Lake.

Kootenai National Forest. More than 48,000 acres of lodgepole pine type is infested with mountain pine beetle on the Kootenai NF. In the area surveyed, an average of 11 trees per acre are infested, with localized areas having as many as 55 infested trees per acre.

Greatest beetle activity is in the Yaak River drainage.

Acres of infested lodgepole pine more than doubled from 1978 to 1979 on the Fisher River RD. Groups of 2 to 600 infested trees per group are distributed on all ownerships throughout the District. Greatest amount of tree kill occurs on the south half of the District although potential outbreaks are developing throughout the District. Mortality of ponderosa pine increased from 30 trees in 1978 to over 400 trees in 1979.

On the Rexford RD small "hot spots" developed in lodgepole pine stands in several drainages. Ponderosa pine was killed in two groups of 30 and 50 trees in upper Sinclair Creek.

Acreage of lodgepole pine infested almost tripled on the Libby RD from 590 acres in 1978 to 1,700 acres in 1979.

Lolo National Forest. Infestations were mapped on about 14,000 acres in 1979 compared to about 16,000 acres in 1978 in lodgepole and ponderosa pine stands on the Lolo NF. An

Table 1 - *Acres of mountain pine beetle infestation in the Northern Region in 1978 and 1979.*

	1978			1979			Net Change		
	Lodgepole pine	Ponderosa pine	Whitebark pine	Lodgepole pine	Ponderosa pine	Whitebark pine	Lodgepole pine	Ponderosa pine	Whitebark pine
Beaverhead	62,072	0	5,303	95,102	0	3,231	+ 33,030	0	−2,072
Bitterroot	499	2,892	0	649	1,076	0	+ 150	−1,816	0
Custer	0	0	0	1	77	0	+ 1	+ 77	0
Deerlodge	32	0	6,118	245	0	180	+ 213	0	−5,938
Flathead	78,561	1,291	150	97,237	386	23,708	+ 18,676	-905	+ 23,558
Gallatin	244,699	0	0	441,252	0	225	+ 196,553	0	+ 225
Helena	737	200	453	1,065	428	895	+ 328	+ 228	+ 442
Kootenai	26,535	130	0	48,599	615	0	+ 22,064	+ 485	0
Lewis & Clark	0	34,244	0	30	15,010	361	+ 30	−19,234	361
Idaho Panhandle	0	550	0	0	0	0	0	−550	0
Lolo	11,059	4,719	50	9,020	4,852	10	-2,039	+ 133	−40
Nezperce	800	0	0	300	0	0	-500	0	0
Glacier NP	164,017	0	0	206,115	0	8,912	+ 42,098	0	+ 8,912
Yellowstone NP	171,244	0	0	431,114	0	0	+ 259,870	0	0
Other ownership[1]	20,889	20,982	25	5,767	21,835	494	-15,122	+ 853	+ 469
Total	**781,144**	**65,008**	**12,099**	**1,336,496**	**44,279**	**38,016**			

[1]Indian Reservations, BLM, and State forests

additional 13,600 acres of infestation was also mapped in lodgepole and ponderosa pine stands on adjacent State and private lands.

Acreage infested declined slightly in the Thompson River drainage on the Plains RD. Most extensive infestation occurs on 5,500 acres of Meadow, Lazier, Whitney, Fishtrap, Cool, and Mantrap drainages. Scattered groups of faded trees ranging from 5 to 1,000 trees per group occur on mixed ownerships. Infested trees average 15 per acre in areas surveyed. Salvage logging appears to have reduced infestation in some locations, but the potential for increased mortality still exists in high risk stands.

Infestation increased from 288 acres in 1978 to 450 acres in 1979 in lodgepole pine stands on the Thompson Falls RD and several hundred lodgepole and ponderosa pine were killed along the Clark Fork River near St. Regis. Mortality centers contained from 2 to 300 trees per center.

Area of ponderosa pine faders increased from 740 acres in 1978 to 958 acres in 1979 on the Missoula RD. Small groups of 1 to 20 trees were widely scattered in the Rock Creek drainage and along the Clark Fork River east of Missoula.

New infestations developed in lodgepole pine stands on the Seeley Lake RD with small group kills occurring at numerous locations. Several hundred ponderosa pines were infested near Upsata and Elbow Lakes. Extensive mortality of second-growth ponderosa pine occurred over 10,500 acres of private ownership along the Blackfoot River. These infestations are continuing to expand with significant attack currently occurring at most locations.

Lewis & Clark National Forest. Infestation in second-growth ponderosa pine declined from about 34,000 acres in 1978 to 15,000 in 1979. Newly attacked trees average 1 per acre in areas surveyed. On the Judith RD infestation increased from 1,600 acres in 1978 to 4,200 in 1978, with greatest activity in the Judith River and Yogo Creek drainages and on Woodhurst Mountain.

New beetle infestation developed in lodgepole pine stands on about 200 acres of the White Sulphur Springs RD.

Infestation occurred on several thousand acres of BLM and private land south of Lewiston. Several thousand acres of additional infestation occurred in second-growth ponderosa pine stands in the Judith Mountains and on South Moccasin Mountain north of Lewiston. The 1979 drought may make trees more susceptible to beetle attack and result in increased tree mortality in 1980.

Bitterroot National Forest. Mountain pine beetle infestation declined from 3,391 acres in 1978 to 1,725 acres in 1979. About 500 second-growth ponderosa pine in groups of 5 to 15 trees per group were killed on the Stevensville RD. The infestation in mixed lodgepole and ponderosa pine on the north side of Shook Mountain continued to decline with about 450 trees being killed. Small groups of 5 to 20 trees per group of lodgepole and ponderosa pine were killed at several locations on the West Fork RD.

Helena National Forest. Epidemic infestation increased from about 1,400 acres in 1978 to nearly 2,400 acres in 1979 on the Helena NF. Infestation remained static on about 725 acres of lodgepole pine on the Townsend RD; less than 1,000 trees were killed. Infestation almost doubled from 453 to 895 acres in whitebark pine stands. Several small groups (6 to 50 trees per group) of ponderosa and lodgepole pine were killed on the Lincoln RD.

Deerlodge National Forest. New outbreaks developed in lodgepole pine stands on the Deerlodge NF where many trees were killed in scattered groups of 2 to 120 trees per group on the Jefferson RD. Mortality in whitebark pine stands declined from about 6,100 acres in 1978 to 180 acres in 1979 near Elkhorn City.

Crow Indian Reservation. Beetle infestation declined in second-growth ponderosa pine stands from 7,100 acres in 1978 to 1,940 in 1979. Newly attacked trees average 39 per acre where surveyed in the Wolf Mountains. Isolated groups of faders were mapped in the North Fork of Indian Creek, Steve Canyon, Little Thompson, and Thompson drainages. Salvage logging removed 1.5 million board feet (mmbf) from 500 acres in 1979. Additional sales to log infested stands are planned for 1980.

Ft. Belknap Indian Reservation. Area of infestation declined in second-growth ponderosa pine stands from 995 acres in 1978 to 592 acres in 1979. Groups of faded trees (2 to 350 trees per group) were mapped during this year's aerial survey.

Blackfeet Indian Reservation. Mountain pine beetle infested 200 acres of lodgepole pine stands in Lee, Sandy Ridge, Chief Mountain, Boulder, and Swift Current drainages. Where surveyed, newly attacked trees averaged 18 per acre.

Craig Mountains—BLM—Idaho. Lodgepole pine faders were mapped on 1,750 acres in 1979, a decline of 770 acres from 1978. Newly attacked trees averaged 17 per acre where surveyed. Logging infested and high risk stands is reducing the current infestation level and potential for future epidemics.

Other Bark Beetles

Montana. Bark beetle activity in Montana, other than mountain pine beetle, was relatively light in 1979. The most significant beetle was the western balsam bark beetle which infested subalpine fir on 9,237 acres in 1979 compared with 6,383 acres in 1978 (figure 4). Most concentrated groups of killed trees were on the Beaverhead, Flathead, Helena, and Lewis & Clark NF's, and Yellowstone NP. The only other beetle to increase over 1978 activity was the Douglas-fir beetle. It infested 753 acres vs. 90 acres in 1978. Most of this activity (671 acres) was on the Gallatin NF.

Figure 4. Subalpine fir killed by the western balsam bark beetle.

Despite the hot, dry summer of 1979, very little damage was caused by the pine engraver beetle. Only 20 acres of pine engraver activity were mapped. The 1979 drought effects may lead to higher pine engraver populations in 1980.

Idaho. Douglas-fir beetle caused mortality on 1,060 acres of mature and over-mature stands on the Selway RD, Nezperce NF, and on 250 acres on the Lochsa RD, Clearwater NF. This is an increase of about 350 acres from 1978. Another 35 acres were infested in the BLM administered Craig Mountains south of Lewiston, Idaho.

Fir engraver beetle infestations in grand fir increased on the Nezperce and Clearwater NF's, and remained static on the Idaho Panhandle NF's. Area of infestation declined from 4,700 to 860 acres on State and private lands in Idaho. Active infestation still persists on 750 acres in the West St. Joe State Forest and on 100 acres in lands managed by the Clearwater Potlatch Protective Association.

Pine engraver beetle populations declined to endemic levels on National Forest land, but are active on about 900 acres of the Pend Oreille, W. St. Joe, and Kendrick State Forests.

Western pine beetle infestations have declined to low levels.

Figure 5. Western spruce budworm defoliation visible from the air in the Northern Region, 1979.

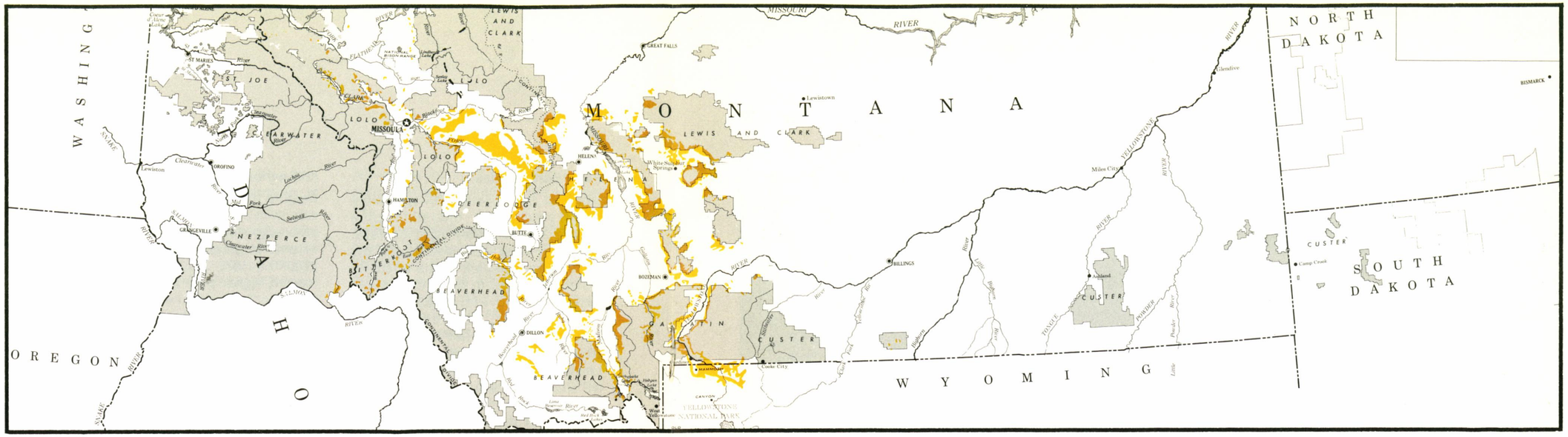


Figure 6. Areas of mountain pine beetle infestation in the Northern Region, 1979.

Western Spruce Budworm

The western spruce budworm epidemic declined by about 200,000 acres in the Region from 1978 to 1979 (table 2). For the first time in 17 years no budworm-caused defoliation was detected on the northern Idaho NF's. Significant declines in area of defoliation occurred on the Bitterroot, Helena, Flathead, and Kootenai NF's; the Flathead Indian Reservation; and Yellowstone National Park. Large increases in areas defoliated occurred on the Lolo, Deerlodge, Lewis and Clark, Gallatin and Beaverhead NF's (figure 5).

Egg populations were surveyed from selected areas on the Lolo, Helena, Beaverhead, and Custer NF's to predict budworm populations in 1980. Moderate to heavy defoliation is anticipated at each location except on the Lolo where a substantial decline in defoliation should occur.

A field experiment to evaluate the effectiveness of aerially applied Permethrin®, carbaryl, SIR-8514®, and imidan on budworm outbreaks was conducted by the Pacific Southwest Forest and Range Experiment Station on the White Sulphur RD, Lewis and Clark NF.

Carbaryl and Permethrin gave good results whereas imidan and SIR-8514 were ineffective at the rates used. Carbaryl is recommended for pilot testing at ½ lb. per acre, and Permethrin is scheduled for safety testing in 1981. Future testing of imidan is planned to determine the effective rate but no futher aerial testing is planned for SIR-8514.

Field experiments were also conducted by research scientists from the Pacific Southwest and Pacific Northwest Forest and Range Experiment Stations on the Bozeman-Gallatin RD, Gallatin NF. These experiments assessed the effect of three chemical insecticides (acephate, Bolstar®, and UC-51762®, the bacterium *Bacillus thuringiensis* (Thuricide 16b®) and two baculoviruses (C. *murinana*-NPV and C. *viridis* GV) on budworm when applied to individual trees with

Table 2 · *Acres of aerially visible[1] western spruce budworm defoliation in the Northern Region in 1978 and 1979.*

Unit[2]	Acres of Visible Defoliation		Changes in Size of Infestation
Northern Idaho	**1978**	**1979**	**Area**
	Acres		
Clearwater NF	8,115	0	– 8,115
Idaho Panhandle NF	7,416	0	– 7,416
Nezperce NF	4,590	0	– 4,590
Subtotal	20,121	0	– 20,121
Montana			
Beaverhead NF	223,720	349,889	+ 126,169
Bitterroot NF[3]	379,112	95,332	– 283,780
Custer NF	3,625	5,373	+ 1,748
Deerlodge NF	382,762	402,638	+ 19,876
Flathead IR	50,566	3,523	– 47,043
Flathead NF	15,171	1,803	– 13,368
Gallatin NF	293,265	325,921	+ 32,656
Helena NF	575,151	463,175	– 111,976
Kootenai NF	14,604	1,438	– 13,166
Lewis & Clark NF	176,294	211,493	+ 35,199
Lolo NF	281,161	335,312	+ 54,151
Subtotal	2,395,431	2,195,897	
Wyoming			
Yellowstone NP	104,694	75,525	– 29,169
Grand Total	**2,520,246**	**2,271,422**	**– 248,824**

[1]Aerially visible defoliation occurs when 25 percent or more of current foliage is destroyed.

[2]Includes Federal, State, and private land.

[3]A portion of this Forest is in northern Idaho. (About 10,000 acres in northern Idaho were defoliated in 1979 compared to about 35,000 in 1978.)

Figure 7. Two normal Douglas-fir cones and two shriveled conelets killed by early instar budworm.

Figure 8. Spraying individual trees for western spruce budworm control.

*Figure 9. Defoliation caused by **Argyrotaenia** near **gogana.***

*Figure 10. Larva of **Argyrotaenia** near **gogana**, a new budworm pest in the Region.*

ground spraying equipment or equipment to simulate aerial spraying (figure 8). Thuricide applied with a hydraulic sprayer was an effective treatment. Data are being submitted to the manufacturer to support registration. Results of two hydraulic applications of a baculovirus were inconclusive, so a re-evaluation is planned for 1980. Simulated aerial spraying of acephate at the registered rate caused a population reduction of 90 percent, and the most effective dosages for Bolstar and UC-51762 gave population reductions of 86 and 98 percent respectively.

A demonstration of Douglas-fir foliage and cone protection by an early application of carbaryl and acephate with ground spraying equipment was conducted at the Lubrecht State Experimental Forest in Montana. Foliage protection was 85 percent for acephate and 97 percent for carbaryl. The mature larval population was reduced 83 percent by acephate and 94 percent by carbaryl. Number of sound seed produced per cone was .51 for acephate and 1.01 for carbaryl treated cones. No seed was produced on the check trees. A project to evaluate effect of multiple applications is planned for 1980.

Larch Casebearer

Casebearer defoliation is heaviest around lakes and along bottoms of major river drainages in northern Idaho and western Montana. In Idaho heavy defoliation was noted from the Canadian border south to the Palouse River. Some of this defoliation can be confused with that caused by two needle diseases and the larch sawfly. In Montana, heavy defoliation occurred in the Flathead, Stillwater, Swan, Clearwater, and Fisher River drainages. Evaluations of casebearer parasites were not made this year.

Regeneration Pests

One hundred thirty-three plantations (5 to 15 years old) were surveyed on the Lolo, Flathead, Clearwater, Bit-

terroot, and Idaho Panhandle NF's to determine causes of seedling injury or mortality. No one insect, or group of insects, caused significant injury to these age classes. However, western spruce budworm defoliation and porcupine damage were observed commonly in Bitterroot plantations, and white pine blister rust was common in Clearwater plantations. Western pine shoot borer was common in young ponderosa pine in the Idaho Panhandle NF's near Coeur d'Alene. Lodgepole terminal weevil damage was seen often in young lodgepole pine on the Beaverhead NF.

Cone and Seed Insects

One seed orchard and 29 seed production areas were surveyed for cone and seed insects and their impacts assessed. Douglas-fir, grand fir, western larch, Engelmann spruce, lodgepole pine, ponderosa pine, and western white pine were checked. In general, the cone crop was poor throughout the Region. Insect injury was extremely heavy as is usually the case during years of poor cone crops. Greatest losses to cones of Douglas-fir, grand fir, and western larch were caused by western spruce budworm, midges, and coneworms (figure 7). Ponderosa pines were most severely damaged by coneworms. The mountain pine cone beetle was the primary pest of western white pine and destroyed nearly the entire cone crop at the Sandpoint, Idaho seed orchard.

Forest Tent Caterpillar

Aspen stands in the Turtle Mountains of North Dakota have been severely defoliated by this caterpillar since 1976. About 150,000 acres were infested in 1978. Larval and pupal mortality from parasites and diseases was very heavy and egg mass counts were low in most stands that fall. Aerial and ground detection surveys in June 1979 showed that defoliation was widely scattered in 30 to 80 acre patches. Most damage was east of Metiogoshe and Carpenter Lakes. No defoliation was detected on the Turtle Mountains Indian Reservation. Evidence of caterpillar populations was hard to detect by the fall of 1979. The epidemic will probably end during 1980.

Sawflies in Western Larch

Two sawflies have been active in western larch stands in Montana and northern Idaho since 1977, but casebearer defoliation and needle diseases have made aerial detection of sawfly damage difficult. Nearly 14,000 acres were infested by sawflies on the Kaniksu portion of the Idaho Panhandle NF's in 1979. Damage occurred east of Priest Lake, south of Sandpoint, and south of Newport, Washington.

Cankerworms

Cankerworms continued to defoliate Siberian elm shelterbelts and occasional patches of American elms along major rivers in North Dakota. Some of the heaviest populations were on shelterbelts in Bottineau, McHenry, Burleigh, and Ransom Counties. A 1978 demonstration of aerially applied *Bacillus thuringiensis,* at one-half pound per acre, showed continued foliage protection in 1979 on Siberian elm belts around Bismarck.

A New Budworm

Larvae of this moth were discovered feeding on mountain hemlock and other conifers in October 1978. They had heavily defoliated about 40 acres north of Wallace, Idaho in Hell's Gulch of the Shoshone Creek drainage. This year the infestation spread to about 1,500 acres north and south of Hell's Gulch and caused severe defoliation in sapling and pole-size hemlock and subalpine fir understory (figures 9, 10). Both current and old foliage was consumed. Ground surveys revealed that defoliation was also present in a few thousand acres along the east ridges of Shoshone Creek and had extended into Montana west of Noxon. Pupal parasitism was near 20% in December west of Noxon. Pupal mortality from unknown causes was about 29 percent. The outbreak is expected to continue and spread in 1980.

Douglas-fir Tussock Moth

Tussock moth populations remain endemic in the Region. Pheromone baited sticky traps at 28 locations captured only a few male moths; numbers per trap were too low to suggest epidemic populations next year.

Pine Needle Sheathminer

Light defoliation by this moth occurred in a 16 mile long belt of ponderosa pine paralleling U.S. 91 south of Helena, Montana. The infestation covered about 18,000 acres.

Pine Butterfly

The pine butterfly outbreak that started in the early 70's in western Montana has ended. No defoliation was visible from the air, and only a relatively few adults were seen flying around crowns of ponderosa pines in previously infested areas.

Gouty Pitch Midge

Damage to young ponderosa pine trees by the gouty pitch midge declined significantly. Only scattered injury to new shoots persists in northern Idaho.

A Needle Miner in Ponderosa Pine

The outbreak of this insect declined from 3,182 acres of defoliation in 1978 to no detectable defoliation in 1979. This needle miner first defoliated 10,000 acres of ponderosa pine in western Montana in 1977. Although no defoliation occurred this year, larvae were still numerous enough to allow collection west of Arlee and north of Frenchtown.

Pathology

Winter Damage

Winter damage to conifers was widespread in northern Idaho and western Montana (figure 11). Areas with severe damage include Priest Lake, Bull Lake, Libby, upper Lochsa River, and lower Blackfoot River. Discoloration frequency and severity varied by area, microsite, and species. In order of decreasing susceptibility, trees affected were: western hemlock, western white pine, western red cedar grand fir, ponderosa pine, and Douglas-fir. Lodgepole pine, subalpine fir, and Engelmann spruce were seldom affected. Small trees were seldom affected. Small trees in openings were most severely affected. Injury varied from a loss of a few needles to reddening of the entire crown. Unless other stress factors are imposed, most defoliated trees recover the following summer.

Figure 11. Winter damaged lodgepole pine. Lower branches were protected by the snow.

Snow Mold

Snow mold on Douglas-fir was locally prevalent throughout the Region for the first time. Initial symptoms were a slight yellowing or browning of several older age classes of needles in the lower crown in March and April. Affected needles remained on trees throughout the summer and turned brown or almost gray with several rows of small, dark brown fruiting bodies. Young trees with lower branches which had been covered by snow were most severely affected. Some growth loss, but little mortality will result from infection.

Douglas-fir Needle Blight

A needle pathogen occurred on Douglas-fir in the Libby and Columbia Falls areas of northwestern Montana. Symptom development was similar to that of the common Christmas tree blight which is normally seen in the spring and early summer on previous year's needles. In this case, several age classes of needles were affected, and the symptoms were not seen until mid-fall. The pathogen is closely related to the Christmas tree blight fungus.

Needle Casts

Lodgepole pine needle cast, although locally severe in north Idaho, was of generally light intensity in lodgepole pine in the remainder of the Region. Another needle cast caused severe defoliation of whitebark pine on east side National Forests, particularly in the King's Hill area of the Lewis and Clark NF.

Discoloration of conifers caused by other needle pathogens remained static or declined. Most notable in the decline category were Meria needle cast on western larch and Dothistroma needle blight on ponderosa pine.

Nursery Diseases

At the Coeur d'Alene nursery, gray mold caused widespread and nearly complete defoliation of 2-0 western larch (figure 12). Cool, humid conditions favored disease development in containers and beds. In most instances seedlings were not killed, but put on foliage and developed normally. Loss estimates are unavailable.

At the Coeur d'Alene nursery greenhouse and in other greenhouse operations in the Region, gray mold could be found causing defoliation, but apparently conditions necessary for serious losses were not reached. The most commonly affected species was western larch but a few 2-3 needle pines had stems girdled.

Rodents

Rodents of some type girdled sapling-size western larch in thinned and unthinned stands on the Eureka RD, Kootenai NF, Montana (figure 13). As many as 25 percent of the residual stems in thinned areas had dead tops.

Other Diseases

Dwarf mistletoes and root pathogens cause the major disease problems in the Region. Mistletoes cause an estimated annual growth loss of about 93 million cubic feet (MMCF); root diseases cause an additional annual impact of nearly 87 MMCF. Stem decays, rusts, and cankers probably cause no more than 1.5 MMCF per year impact.

Figure 12. Western larch seedlings damaged by the gray mold fungus.

Figure 13. Rodent girdled trees in a western larch plantation. Crowns of girdled trees are brown; yellow trees show natural autumn color.

Appendix

Forest Insect and Disease Management Publications and Reports

Bennett, D.D. Pilot survey to measure annual mortality caused by mountain pine beetle in lodgepole pine on the Beaverhead, Gallatin, and Flathead Forests in 1978. Report 79-12.

Bennett, D.D., and W.E. Bousfield. A pilot survey to measure annual mortality by mountain pine beetle. Report 79-20.

Bousfield, W.E. R-1 forest insect and disease damage survey system. Report 79-2.

Bousfield, W.E. Progress report on spruce budworm damage in Idaho and Montana, 1978. Report 79-11.

Bousfield, W.E., and G.C. Franc. Remeasurement of western spruce budworm damage areas on the Clearwater National Forest, Idaho, 1978. Report 79-8.

Carlson, C.E., C.C. Gordon, and C.J. Gilligan. The relationship of fluorides to visible growth/health characteristics of Pinus monticola, Pinus contorta, and Pseudotsuga menziesii. Fluoride 12/1:9-17.

Dewey, J.E., and M.J. Jenkins. An evaluation of cone and seed insects in selected seed production areas of Region 1 (progress report). Report 79-16.

Dooling, O.J. Dwarf mistletoe loss assessment in east side Northern Region National Forests. Report 79-13.

Dooling, O.J. Evaluation of a proposed dwarf mistletoe management project on the Sula Ranger District, Bitterroot National Forest. Report 79-17.

Flavell, T.H. Reevaluation of larch casebearer parasites in casebearer-infested stands of Region 1. Report 79-3.

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Hard, J.S. A reevaluation of 1978 *Bacillus thuringiensis* applications for cankerworm control in Siberian elm shelterbelts. Report 79-18.

Hard, J.S., Richard Frye, Donald Carey, and Mary Ellen Dix. An evaluation of day and night aerial BT applications for cankerworm control in Siberian elm shelterbelts. Unnumbered report.

Hard, J.S., and John Rice. Preliminary results of seedling damage survey in young plantations on selected forests in Region 1. Report 79-10.

McGregor, M.D. A demonstration of lodgepole pine management to prevent mountain pine beetle outbreaks —Yaak and Thompson River drainages. Progress report. Report 79-14.

McGregor, M.D., D.D. Bennett, and H.E. Meyer. Evaluation of mountain pine beetle infestation, Hebgen Lake Ranger District, Gallatin National Forest, Montana, 1978. Report 79-6.

McGregor, M.D., and K.E. Gibson. Evaluation of the mountain pine beetle infestation, Blackfeet Indian Reservation and East Side Glacier National Park, Montana, 1979. Report 79-21.

McGregor, M.D., K.E. Gibson, and D.D. Bennett. Bark beetle conditions, Northern Region, 1978. Report 79-4.

Robinson, Laird A., J.E. Dewey, and C.E. Carlson. Forest insect and disease conditions in the Northern Region, 1978. Report R1-79-17.

Walsh, Natalie, and Gael Bissell. Impact of copper smelter emissions on two subalpine ecosystems near Anaconda, Montana. Report 79-7.

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Forest Insect and Disease Common/Scientific Names

	Common Name	Scientific Name
INSECT NAMES	Cankerworms	*Paleacrita vernata* (Peck)
		Alsophila pometaria (Harris)
	Coneworms	*Dioryctria* sp.
	Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
	Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
	Forest tent caterpiller	*Malacosoma disstria* Hübner
	Gouty pitch midge	*Cecidomyia piniinopsis* Osten Sacken
	Larch casebearer	*Coleophora laricella (*Hübner)
	Lodgepole terminal weevil	*Pissodes terminalis* Hopping
	Midges	*Contarinia* sp.
	Mountain pine beetle	*Dendroctonus ponderosae* Hopkins
	Mountain pine cone beetle	*Conophthorus monticolae* Hopkins
	New budworm	*Argyrotaenia* sp. near *gogana* (Kearfott)
	Pine butterfly	*Neophasia menapia* (Felder & Felder)
	Pine needle sheathminer	*Zelleria haimbachi* Busck
	Ponderosa pine needle miner	*Coleotechnites* sp.
	Western balsam bark beetle	*Dryocoetes confusus* Swaine
	Western larch sawflies	*Anoplonyx* sp.
		Pristiphora erichsonii (Hartig)
	Western pine shoot borer	*Eucosma sonomana* Kearfott
	Western spruce budworm	*Choristoneura occidentalis* Freeman
DISEASE NAMES	Christmas tree blight	*Rhabdocline pseudotsugae* Syd.
	Dothistroma needle blight	*Scirrhia pini* Funk & A.K. Parker
	Douglas-fir needle blight	*Rhabdocline weirii* Parker & Reid
	Gray mold	*Botrytis cinerea* Per. ex Fr.
	Lodgepole pine needle cast	*Lophdermella concolor* (Dearn.) Darker
	Meria needle cast	*Meria laricis* Vuill.
	Snow mold	*Phacidium infestans* Karst.
	Whitebark pine needle cast	*Lophodermella arcuata* (Darker) Darker

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